

## **Disinfectant Glass Wipe**

### **FIELD OF THE INVENTION**

The present invention relates generally to disinfecting hard surface cleaning wet wipes and cleaning pads for use on glass. More particularly, the present invention relates to disinfecting wet wipes and cleaning pads with a low concentration of volatile organic solvents and low streaking and filming.

### **BACKGROUND OF THE INVENTION**

For many cleaning applications, it is desirable to combine cleaning, disinfection, and a delivery mechanism such as a wipe. Thus, several commercially available disinfectant wipes have been developed. Most of these products depend upon quaternary ammonium disinfectants to provide disinfection. These wet wipe products are suitable for general cleaning, however, they tend to leave streaking, filming, or spots on glass surfaces. Some disinfecting glass cleaners have been developed that contain no quaternary ammonium disinfectants, but instead depend upon relatively high levels of volatile solvents for disinfection, i.e. WO00/71661 to Harrison et al. This can be a disadvantage in a wet wipes product because the volatile solvent can evaporate during storage or use, and the wet wipe may no longer be disinfecting. The high solvent levels may also contribute to filming and streaking. It would be desirable to develop a disinfecting wet wipe for glass or glass and other surfaces that contains relatively low levels of solvent and does not depend upon quaternary ammonium compounds for disinfectancy.

Some acidic glass and hard surface cleaners have also been developed. While these solutions (e.g., those comprising sources of hydrogen peroxide, quaternary ammonium compounds and citric acid) deliver a high degree of anti-microbial efficacy they can leave a filmy surface because they contain solids and need to be used at high levels described in US2002/166573 to Policicchio et al.

The art recognizes the use of pre-moistened wipes. For example, U.S. Pat. No. 4,276,338 to Ludwa et al. discloses a multi-laminate absorbent article comprising adjacent first and second layers maintained together to improve wicking. U.S. Pat. No. 4,178,407 to Rubens discloses a single towel having absorbent surface on both sides that additionally comprises an inner layer impermeable to liquid. The towel is designed to have little wet strength and the layer of absorbent material consists of loose fibers. The art also discloses pre-moistened wipes for use in glass cleaner applications. U.S. Pat. No. 4,448,704 to Barby discloses an article suitable for cleaning hard surfaces such as glass. The article may be wet or consist of a cleaning solution present within ruptural pouches. The article of U.S. Pat. No. 4,448,704 is pre-washed with demineralized water or the solution used to impregnate said article; the liquid composition has a surface tension of less than 35 dynes/cm, and preferably includes a surface-active agent and a partially esterified resin such as a partially esterified styrene/maleic anhydride copolymer. All of said patents are incorporated herein by reference.

It is therefore an object of the present invention to provide an improved disinfectant or sanitizing wipe or pad that overcomes the aforementioned drawbacks and disadvantages that are often associated with conventional wet wipes or pads.

#### SUMMARY OF THE INVENTION

In accordance with the above objects and those that will be mentioned and will become apparent below, the cleaning composition in accordance with this invention comprises a disinfectant or sanitizing wipe or cleaning pad, for cleaning glass and other glossy surfaces and not dependent upon quaternary ammonium compounds for disinfectancy, comprising:

- a. a substrate and
- b. a cleaning composition comprising:
  - i. less than 4% total organic solvent and
  - ii. greater than 0.05% sodium hydroxide or potassium hydroxide.

In another embodiment, the invention comprises a disinfectant or sanitizing wipe or cleaning pad, for cleaning glass and other glossy surfaces and not dependent upon quaternary ammonium compounds for disinfectancy, comprising:

- a. a substrate and
- b. a cleaning composition comprising:
  - i. less than 4% organic solvent having a vapor pressure less than 0.1 mm Hg (20° C) and
  - ii. greater than 0.05% sodium hydroxide or potassium hydroxide.

In another embodiment, the invention comprises a disinfectant or sanitizing wipe or cleaning pad, for cleaning glass and other glossy surfaces and not dependent upon quaternary ammonium compounds for disinfectancy, comprising:

- a. a substrate and
- b. a cleaning composition comprising:
  - i. less than 4% total organic solvent and
  - ii. having a pH greater than about 10.

In another embodiment, the invention comprises a disinfectant or sanitizing wipe or cleaning pad, for cleaning glass and other glossy surfaces and not dependent upon quaternary ammonium compounds for disinfectancy, comprising:

- a. a substrate and
- b. a cleaning composition comprising:
  - i. less than 4% organic solvent having a vapor pressure less than 0.1 mm Hg and
  - ii. having a pH greater than about 10.

In another embodiment, the invention comprises a method of disinfecting or sanitizing a glass or other glossy surface comprising wiping the surface with a wipe or cleaning pad, not dependent upon quaternary ammonium compounds for disinfectancy, comprising:

- a. a substrate and
- b. a cleaning composition comprising:
  - i. less than 4% total organic solvent and
  - ii. greater than 0.05% sodium hydroxide or potassium hydroxide.

#### DETAILED DESCRIPTION OF THE INVENTION

Before describing the present invention in detail, it is to be understood that this invention is not limited to particularly exemplified systems or process parameters as such may, of course, vary. It is also to be understood that the terminology used herein is for the purpose of describing particular embodiments of the invention only, and is not intended to limit the scope of the invention in any manner.

All publications, patents and patent applications cited herein, whether *supra* or *infra*, are hereby incorporated by reference in their entirety to the same extent as if each individual publication, patent or patent application was specifically and individually indicated to be incorporated by reference.

It must be noted that, as used in this specification and the appended claims, the singular forms "a," "an" and "the" include plural referents unless the content clearly dictates otherwise. Thus, for example, reference to a "surfactant" includes two or more such surfactants.

Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which the invention pertains. Although a number of methods and materials similar or equivalent to those described herein can be used in the practice of the present invention, the preferred materials and methods are described herein.

The improved disinfecting or sanitizing wipe or pad can be used as a disinfectant, sanitizer, and/or sterilizer. As used herein, the term "disinfect" shall mean the elimination of many or all pathogenic microorganisms on surfaces with the exception of bacterial endospores. As used herein, the term "sanitize" shall mean the reduction of contaminants in the inanimate environment to levels considered safe according to public health ordinance, or that reduces the bacterial population by significant numbers where public health requirements have not been established. An at least 99% reduction in bacterial population within a 24 hour time period is deemed "significant." As used herein, the term "sterilize" shall mean the complete elimination or destruction of all forms of microbial life and which is authorized under the applicable regulatory laws to make legal claims as a "Sterilant" or to have sterilizing properties or qualities. The phrase "not dependent upon quaternary ammonium compounds for disinfectancy" means that the composition disinfects if any quaternary ammonium compounds present were not present.

In the application, effective amounts are generally those amounts listed as the ranges or levels of ingredients in the descriptions, which follow hereto. Unless otherwise stated, amounts listed in percentage ("%s") are in weight percent (based on 100% active) of the cleaning

composition alone, not accounting for the substrate weight. Each of the noted cleaner composition components and substrates is discussed in detail below.

### **Substrate**

The hard surface cleaning compositions described herein can be used in a pre-moistened wipe or pad, which can be used to wipe surfaces either alone or in combination with a handle to form a cleaning implement as described hereinafter. The wipe substrate can be composed of suitable unmodified and/or modified naturally occurring fibers including cotton, Esparto grass, bagasse, hemp, flax, silk, wool, wood pulp, chemically modified wood pulp, jute, ethyl cellulose, and/or cellulose acetate. Suitable synthetic fibers can comprise fibers of one, or more, of polyvinyl chloride, polyvinyl fluoride, polytetrafluoroethylene, polyvinylidene chloride, polyacrylics such as ORLON®, polyvinyl acetate, Rayon®, polyethylvinyl acetate, non-soluble or soluble polyvinyl alcohol, polyolefins such as polyethylene (e.g., PULPEX®) and polypropylene, polyamides such as nylon, polyesters such as DACRON® or KODEL®, polyurethanes, polystyrenes, and the like, including fibers comprising polymers containing more than one monomer. The wipe substrate can comprise solely naturally occurring fibers, solely synthetic fibers, or any compatible combination of naturally occurring and synthetic fibers.

The fibers useful herein can be hydrophilic, hydrophobic or can be a combination of both hydrophilic and hydrophobic fibers. As indicated above, the particular selection of hydrophilic or hydrophobic fibers depends upon the other materials included in the absorbent (and to some degree) the scrubbing layer described hereinafter. Suitable hydrophilic fibers for use in the present invention include cellulosic fibers, modified cellulosic fibers, rayon, cotton, polyester fibers such as hydrophilic nylon (HYDROFIL®). Suitable hydrophilic fibers can also be obtained by hydrophilizing hydrophobic fibers, such as surfactant-treated or silica-treated thermoplastic fibers derived from, for example, polyolefins such as polyethylene or polypropylene, polyacrylics, polyamides, polystyrenes, polyurethanes and the like.

Suitable wood pulp fibers can be obtained from well-known chemical processes such as the Kraft and sulfite processes. It is especially preferred to derive these wood pulp fibers from southern soft woods due to their premium absorbency characteristics. These wood pulp fibers can also be obtained from mechanical processes, such as ground wood, refiner mechanical, thermomechanical, chemimechanical, and chemi- thermomechanical pulp processes. Recycled or secondary wood pulp fibers, as well as bleached and unbleached wood pulp fibers, can be used.

Another type of hydrophilic fiber for use in the present invention is chemically stiffened cellulosic fibers. As used herein, the term "chemically stiffened cellulosic fibers" means cellulosic fibers that have been stiffened by chemical means to increase the stiffness of the fibers under both dry and aqueous conditions. Such means can include the addition of a chemical stiffening agent that, for example, coats and/or impregnates the fibers. Such means can also include the stiffening of the fibers by altering the chemical structure, e.g., by crosslinking polymer chains.

Where fibers are used as the absorbent layer (or a constituent component thereof), the fibers can optionally be combined with a thermoplastic material. Upon melting, at least a portion of

this thermoplastic material migrates to the intersections of the fibers, typically due to interfiber capillary gradients. These intersections become bond sites for the thermoplastic material. When cooled, the thermoplastic materials at these intersections solidify to form the bond sites that hold the matrix or web of fibers together in each of the respective layers. This can be beneficial in providing additional overall integrity to the cleaning wipe.

Amongst its various effects, bonding at the fiber intersections increases the overall compressive modulus and strength of the resulting thermally bonded member. In the case of the chemically stiffened cellulosic fibers, the melting and migration of the thermoplastic material also has the effect of increasing the average pore size of the resultant web, while maintaining the density and basis weight of the web as originally formed. This can improve the fluid acquisition properties of the thermally bonded web upon initial exposure to fluid, due to improved fluid permeability, and upon subsequent exposure, due to the combined ability of the stiffened fibers to retain their stiffness upon wetting and the ability of the thermoplastic material to remain bonded at the fiber intersections upon wetting and upon wet compression. In net, thermally bonded webs of stiffened fibers retain their original overall volume, but with the volumetric regions previously occupied by the thermoplastic material becoming open to thus increase the average interfiber capillary pore size.

Thermoplastic materials useful in the present invention can be in any of a variety of forms including particulates, fibers, or combinations of particulates and fibers. Thermoplastic fibers are a particularly preferred form because of their ability to form numerous interfiber bond sites. Suitable thermoplastic materials can be made from any thermoplastic polymer that can be melted at temperatures that will not extensively damage the fibers that comprise the primary web or matrix of each layer. Preferably, the melting point of this thermoplastic material will be less than about 190° C., and preferably between about 75° C. and about 175° C. In any event, the melting point of this thermoplastic material should be no lower than the temperature at which the thermally bonded absorbent structures, when used in the cleaning pads, are likely to be stored. The melting point of the thermoplastic material is typically no lower than about 50° C.

The thermoplastic materials, and in particular the thermoplastic fibers, can be made from a variety of thermoplastic polymers, including polyolefins such as polyethylene (e.g., PULPEX®) and polypropylene, polyesters, copolyesters, polyvinyl acetate, polyethylvinyl acetate, polyvinyl chloride, polyvinylidene chloride, polyacrylics, polyamides, copolyamides, polystyrenes, polyurethanes and copolymers of any of the foregoing such as vinyl chloride/vinyl acetate, and the like. Depending upon the desired characteristics for the resulting thermally bonded absorbent member, suitable thermoplastic materials include hydrophobic fibers that have been made hydrophilic, such as surfactant-treated or silica-treated thermoplastic fibers derived from, for example, polyolefins such as polyethylene or polypropylene, polyacrylics, polyamides, polystyrenes, polyurethanes and the like. The surface of the hydrophobic thermoplastic fiber can be rendered hydrophilic by treatment with a surfactant, such as a nonionic or anionic surfactant, e.g., by spraying the fiber with a surfactant, by dipping the fiber into a surfactant or by

including the surfactant as part of the polymer melt in producing the thermoplastic fiber. Upon melting and resolidification, the surfactant will tend to remain at the surfaces of the thermoplastic fiber. Suitable surfactants include nonionic surfactants such as Brij® 76 manufactured by ICI Americas, Inc. of Wilmington, Delaware, and various surfactants sold under the Pegosperse® trademark by Glyco Chemical, Inc. of Greenwich, Conn. Besides nonionic surfactants, anionic surfactants can also be used. These surfactants can be applied to the thermoplastic fibers at levels of, for example, from about 0.2 to about 1 g per square centimeter of thermoplastic fiber.

Suitable thermoplastic fibers can be made from a single polymer (monocomponent fibers), or can be made from more than one polymer (e.g., bicomponent or multicomponent fibers). As used herein, "bicomponent fibers" refers to thermoplastic fibers that comprise a core fiber made from one polymer that is encased within a thermoplastic sheath made from a different polymer. The polymer comprising the sheath often melts at a different, typically lower, temperature than the polymer comprising the core. As a result, these bicomponent fibers provide thermal bonding due to melting of the sheath polymer, while retaining the desirable strength characteristics of the core polymer.

Suitable bicomponent fibers for use in the present invention can include sheath/core fibers having the following polymer combinations: polyethylene/polypropylene, polyethylvinyl acetate/polypropylene, polyethylene/polyester, polypropylene/polyester, copolyester/polyester, and the like. Particularly suitable bicomponent thermoplastic fibers for use herein are those having a polypropylene or polyester core, and a lower melting copolyester, polyethylvinyl acetate or polyethylene sheath (e.g., those available from Danaklon a/s, Chisso Corp., and CELBOND®, available from Hercules). These bicomponent fibers can be concentric or eccentric. As used herein, the terms "concentric" and "eccentric" refer to whether the sheath has a thickness that is even, or uneven, through the cross-sectional area of the bicomponent fiber. Eccentric bicomponent fibers can be desirable in providing more compressive strength at lower fiber thicknesses.

Methods for preparing thermally bonded fibrous materials are described in U.S. Pat. 5,607,414 to Richards et al. and U.S. Pat. No. 5,549, 589 to Homey et al. The absorbent layer can also comprise a HIPE-derived hydrophilic, polymeric foam. Such foams and methods for their preparation are described in U.S. Pat. No. 5,550,167 to DesMarais and U.S. Pat. 5,563,179 to Stone et al. The disclosures of these references are incorporated by reference herein.

The wipe can consist of one or more layers optionally including a scrub layer for maximum cleaning efficiency. For pre-moistened wipes that use a single layer, the layer preferably consists of fibers comprising of some combination of hydrophilic and hydrophobic fibers, and more preferably a composition consisting of at least about 30% hydrophobic fibers and even more preferably at least about 50% of hydrophobic fibers in a hydroentangled web. By hydrophobic fibers, it is meant polyester as well as those derived from polyolefins such as polyethylene, polypropylene and the like. The combination of hydrophobic and absorbent hydrophilic fibers represents a particularly preferred embodiment for the single sheet pre-moistened wipe since the

absorbent component, typically cellulose, aids in the sequestering and removal of dust and other soils present on the surface. The hydrophobic fibers are particularly useful in cleaning greasy soils, in improving the pre-moistened wipe and in lowering the friction between substrate and hard surface (glide). In terms of rank ordering of fiber chemical composition for improved glide, the inventors have found polyester, particularly polyester, along with polypropylene to be most effective in providing excellent glide, followed by polyethylene. Cellulose (or rayon) based pre-moistened wipes, though highly absorbent lead to significant friction between substrate and surface to be cleaned. Fiber compositions that typically have a coefficient of friction with glass can be improved, as needed, by impregnating or chemically bonding the wipe with low levels of silicone or other chemicals that are known to reduce friction. Silicones are preferred since they also reduce composition sudsing, leading to improved result.

Various forming methods can be used to form a suitable fibrous web. For instance, the web can be made by nonwoven dry forming techniques, such as air-laying, or alternatively by wet laying, such as on a paper making machine. Other non-woven manufacturing techniques, including but not limited to techniques such as melt blown, spunbonded, needle punched, and hydroentanglement methods can also be used. In one embodiment, the dry fibrous web can be an airlaid nonwoven web comprising a combination of natural fibers, staple length synthetic fibers and a latex binder. The dry fibrous web can be about 20- 80 percent by weight wood pulp fibers, 10-60 percent by weight staple length polyester fibers, and about 10-25 percent by weight binder.

The dry, fibrous web can have a basis weight of between about 30 and about 200 grams per square meter. The density of the dry web can be measured after evaporating the liquid from the premoistened wipe, and the density can be less than about 0.15 grams per cubic centimeter. The density is the basis weight of the dry web divided by the thickness of the dry web, measured in consistent units, and the thickness of the dry web is measured using a circular load foot having an area of about 2 square inches and which provides a confining pressure of about 95 grams per square inch. In one embodiment, the dry web can have a basis weight of about 64 grams per square meter, a thickness of about 0.06 cm, and a density of about 0.11 grams per cubic centimeter.

In one embodiment, the dry fibrous web can comprise at least 50 percent by weight wood pulp fibers, and more preferably at least about 70 percent by weight wood pulp fibers. One particular airlaid nonwoven web which is suitable for use in the present invention comprises about 73.5 percent by weight cellulosic fibers (Southern softwood Kraft having an average fiber length of about 2.6 mm); about 10.5 percent by weight polyester fibers having a denier of about 1.35 gram/9000 meter of fiber length and a staple length of about 0.85 inch; and about 16 percent by weight of a binder composition comprising a styrene butadiene copolymer. The binder composition can be made using a latex adhesive commercially available as Røvene 5550 (49 percent solids styrene butadiene) available from Mallard Creek Polymers of Charlotte, N.C.

The following patents are incorporated herein by reference for their disclosure related to webs: U.S. Pat. No. 3,862,472; U.S. Pat. No. 3,982,302; U.S. Pat. No. 4,004, 323; U.S. Pat. No.

4,057,669; U. S. Pat. No. 4,097,965; U.S. Pat. No. 4,176,427; U.S. Pat. No. 4,130,915; U.S. Pat. No. 4,135,024; U.S. Pat. No. 4,189,896; U.S. Pat. No. 4,207,367; U.S. Pat. No. 4,296, 161; U.S. Pat. No. 4,309,469; U. S. Pat. No. 4,682,942; U.S. Pat. No. 4,637,859; U.S. Pat. No. 5,223,096; U.S. Pat. No. 5,240,562; U.S. Pat. No. 5,556,509; and U.S. Pat. No. 5,580,423.

In one preferred embodiment, the cleaning sheet has at least two regions where the regions are distinguished by basis weight. Briefly, the measurement is achieved photographically, by differentiating dark (low basis weight) and light (high basis) network regions. In particular, the cleaning sheet comprises one or more low basis weight regions, wherein the low basis region(s) have a basis weight that is not more than about 80% of the basis weight of the high basis weight regions. In one preferred aspect, the first region is relatively high basis weight and comprises an essentially continuous network. The second region comprises a plurality of mutually discrete regions of relatively low basis weight and which are circumscribed by the high basis weight first region. In particular, a preferred cleaning sheet comprises a continuous region having a basis weight of from about 30 to about 120 grams per square meter and a plurality of discontinuous regions circumscribed by the high basis weight region, wherein the discontinuous regions are disposed in a random, repeating pattern and having a basis weight of not more than about 80% of the basis weight of the continuous region.

In one embodiment, the cleaning sheet will have, in addition to regions which differ with regard to basis weight, substantial macroscopic three-dimensionality. The term "macroscopic three-dimensionality", when used to describe three dimensional cleaning sheets means a three dimensional pattern is readily visible to the naked eye when the perpendicular distance between the viewer's eye and the plane of the sheet is about 12 inches. In other words, the three dimensional structures of the pre-moistened sheets of the present invention are cleaning sheets that are non-planar, in that one or both surfaces of the sheets exist in multiple planes. By way of contrast, the term "planar", refers to sheets having fine-scale surface aberrations on one or both sides, the surface aberrations not being readily visible to the naked eye when the perpendicular distance between the viewer's eye and the plane of the sheet is about 12 inches. In other words, on a macro scale the observer will not observe that one or both surfaces of the sheet will exist in multiple planes so as to be three-dimensional.

Briefly, macroscopic three-dimensionality is described in terms of average height differential, which is defined as the average distance between adjacent peaks and valleys of a given surface of a sheet, as well as the average peak to peak distance, which is the average distance between adjacent peaks of a given surface. Macroscopic three dimensionality is also described in terms of surface topography index of the outward surface of a cleaning sheet; surface topography index is the ratio obtained by dividing the average height differential of a surface by the average peak to peak distance of that surface. In a preferred embodiment, a macroscopically three-dimensional cleaning sheet has a first outward surface and a second outward surface wherein at least one of the outward surfaces has a peak to peak distance of at least about 1 mm and a surface topography index from about 0.01 mm to about 10 mm. The macroscopically three-



dimensional structures of the pre-moistened wipes of the present invention optionally comprise a scrim, which when heated and the cooled, contract so as to provide further macroscopic three-dimensional structure.

In another alternative embodiment, the substrate can comprise a laminate of two outer hydroentangled webs, such as nonwoven webs of polyester, rayon fibers or blends thereof having a basis weight of about 10 to about 60 grams per square meter, joined to an inner constraining layer, which can be in the form of net like scrim material which contracts upon heating to provide surface texture in the outer layers.

The pre-moistened wipe is made by wetting the dry substrate with at least about 1.0 gram of liquid composition per gram of dry fibrous web. Preferably, the dry substrate is wetted with at least about 1.5, and more preferably at least about 2.0 grams of liquid composition per gram of the dry fibrous web. The exact amount of solution impregnated on the wipe will depend on the product's intended use. For pre-moistened wipes intended to be used for cleaning counter tops, stove tops, glass etc., optimum wetness is from about 1 gram of solution to about 5 grams of solution per gram of wipe. In the context of a floor cleaning wipe, the pre-moistened substrate can preferably include an absorbent core reservoir with a large capacity to absorb and retain fluid. Preferably, the absorbent reservoir has a fluid capacity of from about 5 grams to about 15 grams per gram of absorptive material. Pre-moistened wipes intended to be used for the cleaning of walls, exterior surfaces, etc. will have a capacity of from about 2 grams to about 10 grams of dry fibrous web.

In the context of glass and other cleaning situations where lower levels of liquid are required to reduce amount of liquids left on surfaces and grease cleaning efficacy is required, a preferred embodiment includes a dry fibrous web substrate where at least about 65% of the dry fibrous web is composed of hydrophobic fibers such as polyester, polypropylene, polyethylene and the like, and lower levels of hydrophilic fibers such as wood pulp, cotton, and the like are at levels of less than about 35%. The lower level of hydrophilic fibers helps reduce how much liquid the wipe can retain while the higher level of hydrophobic fibers helps to better absorb grease.

In addition to using material composition wipe dimension can also be used to control dosing as well as provide ergonomic appeal. Preferred wipe dimensions are from about 5½ inches to about 9 inches in length, and from about 5½ inches to about 9 inches in width to comfortably fit in a hand. As such, the wipe preferably has dimensions such that the length and width differ by no more than about 2 inches. In the context of heavier soil cleaning, wipes are preferably bigger so that they can be used and then folded, either once or twice, so as to contain dirt within the inside of the fold and then the wipe can be re-used. For this application, the wipe has a length from about 5½ inches to about 13 inches and a width from about 10 inches to about 13 inches. As such, the wipe can be folded once or twice and still fit comfortably in the hand.

In addition to having wipes prepared using a mono-layer substrate, it is advantageous in some situations to have the pre-moistened wipe constructed having multiple layers. In a preferred embodiment, the wipe consists of a multi-laminate structure comprising a pre-moistened outer

layer, an impermeable film or membrane inner layer and second outer-layer which is substantially dry. To improve the wet capacity of the wipe and to protect the back layer from getting prematurely wet, an optional absorbent reservoir can be placed between the pre-moistened first outer-layer and the impermeable film or membrane. Preferably, the dimensions of the reservoir are smaller than the dimensions of the two outer layers to prevent liquid wicking from the front layer onto the back layer.

The use of a multi-laminate structure as herein described can be highly desirable in that it allows for a dry buffing step, aimed at substantially removing most of the liquid remaining on the glass following application of the wet side of the pre-moistened wipe on the glass. The multi-laminate structure is further advantageously used in the context of heavier soiled situations, such as those encountered on outside windows or car glass. By allowing use of a fresh, clean surface for buffing, the multi-laminate structure reduces the amount of dirty liquid pushed around by the pre-moistened wipe.

When a multi-laminate structure is used, it is preferred that the outer pre-moistened layer contain at least about 30% hydrophobic fibers for oil remove and glide. The impermeable inner layer is most preferably polyethylene, polypropylene or mixtures thereof. The composition mixture and thickness of the impermeable layer is chosen so as to minimize, or more preferably eliminate any seepage of liquid from the pre-moistened first outer-layer to the dry second outer-layer. Those skilled in the art will appreciate that use of a reservoir core or of a high fluid capacity pre-moistened outer-layer will test the impermeable layer, such that more than one impermeable layer can be required to ensure sufficient dryness for the second outer-layer of the wipe. The reservoir, if present, will preferably consist of treated or untreated cellulose, either as a stand alone material or as a hybrid with hydrophobic fibers. The hydrophobic content of the reservoir layer is preferably less than about 30%, more preferably less than about 20% by weight of the total fiber content of the layer. In a preferred embodiment, the reservoir consists of air-laid cellulose. The second outer-layer, which is substantially dry to the touch, preferably consists of high absorbency cellulose or blends of cellulose and synthetic fibers.

The cleaning wipe, upon which the improved cleaning composition is loaded thereon, is made of an absorbent/adsorbent material. Typically, the cleaning wipe has at least one layer of nonwoven material. Nonlimiting examples of commercially available cleaning wipes that can be used include DuPont 8838, Dexter ZA, Dexter 10180, Dexter M10201, Dexter 8589, Ft. James 836, and Concert STD60LN, and Ahlstrom 4759. All of these cleaning wipes include a blend of polyester and wood pulp. Dexter M10201 also includes rayon, a wood pulp derivative. The loading ratio of the cleaning composition onto the cleaning wipe is about 2-5:1, and typically about 3-4:1. The improved cleaning composition is loaded onto the cleaning wipe in any number of manufacturing methods. Typically, the cleaning wipe is soaked in the improved cleaning composition for a period of time until the desired amount of loading is achieved.

## Surfactant

The components in accord with the invention and the compositions herein preferably contain one or more surfactants selected from anionic, nonionic, cationic, ampholytic, amphoteric and zwitterionic surfactants and mixtures thereof. A typical listing of anionic, nonionic, ampholytic, and zwitterionic classes, and species of these surfactants, is given in U.S. Pat. 3,929,678 to Laughlin and Heuring. A list of suitable cationic surfactants is given in U.S. Pat. 4,259,217 to Murphy. Where present, ampholytic, amphoteric and zwitterionic surfactants are generally used in combination with one or more anionic and/or nonionic surfactants. The surfactants are preferably present at a level of from 0% to 5%, more preferably from 0.001% to 2%, most preferably from 0.01% to 0.5% by weight.

The components in accord with the present invention and/ or the detergent compositions herein may comprise an anionic surfactant. Essentially any anionic surfactants useful for detergative purposes can be comprised in the detergent composition. These can include salts (including, for example, sodium, potassium, ammonium, and substituted ammonium salts such as mono-, di- and triethanolamine salts) of the anionic sulfate, sulfonate, carboxylate and sarcosinate surfactants. Anionic sulfate and sulfonate surfactants are preferred. Preferred are surfactants systems comprising a sulfonate or a sulfate surfactant, preferably an alkyl sulfate, a linear or branched alkyl benzene sulfonate, or an alkyldiphenyloxide disulfonate, as described herein.

Other anionic surfactants include the isethionates such as the acyl isethionates, N-acyl taurates, fatty acid amides of methyl tauride, alkyl succinates and sulfosuccinates, monoesters of sulfosuccinate (especially saturated and unsaturated C12- C18 monoesters) diesters of sulfosuccinate (especially saturated and unsaturated C6-C14 diesters), N-acyl sarcosinates. Resin acids and hydrogenated resin acids are also suitable, such as rosin, hydrogenated rosin, and resin acids and hydrogenated resin acids present in or derived from tallow oil. Anionic sulfate surfactants suitable for use herein include the linear and branched primary and secondary alkyl sulfates, alkyl ethoxysulfates, fatty oleoyl glycerol sulfates, alkyl phenol ethylene oxide ether sulfates, the C5-C17acyl-N-(C1-C4 alkyl) and -N-(C1-C2 hydroxyalkyl) glucamine sulfates, and sulfates of alkylpolysaccharides such as the sulfates of alkylpolyglucoside (the nonionic nonsulfated compounds being described herein). Alkyl sulfate surfactants are preferably selected from the linear and branched primary C10-C18 alkyl sulfates, more preferably the C11-C15 branched chain alkyl sulfates and the C12-C14 linear chain alkyl sulfates.

Alkyl ethoxysulfate surfactants are preferably selected from the group consisting of the C10-C18 alkyl sulfates which have been ethoxylated with from 0.5 to 20 moles of ethylene oxide per molecule. More preferably, the alkyl ethoxysulfate surfactant is a C11-C18, most preferably C11-C15 alkyl sulfate which has been ethoxylated with from 0.5 to 7, preferably from 1 to 5, moles of ethylene oxide per molecule. A particularly preferred aspect of the invention employs mixtures of the preferred alkyl sulfate and/ or sulfonate and alkyl ethoxysulfate surfactants. Such mixtures have been disclosed in PCT Patent Application No. WO 93/18124.

Anionic sulfonate surfactants suitable for use herein include the salts of C5-C20 linear alkylbenzene sulfonates, alkyl ester sulfonates, C6-C22 primary or secondary alkane sulfonates, C6-C24 olefin sulfonates, sulfonated polycarboxylic acids, alkyl glycerol sulfonates, fatty acyl glycerol sulfonates, fatty oleyl glycerol sulfonates, and any mixtures thereof. Suitable anionic carboxylate surfactants include the alkyl ethoxy carboxylates, the alkyl polyethoxy polycarboxylate surfactants and the soaps ('alkyl carboxyls'), especially certain secondary soaps as described herein. Suitable alkyl ethoxy carboxylates include those with the formula  $RO(CH_2CH_2O)_xCH_2COO^-M^+$  wherein R is a C6 to C18 alkyl group, x ranges from 0 to 10, and the ethoxylate distribution is such that, on a weight basis, the amount of material where x is 0 is less than 20 % and M is a cation. Suitable alkyl polyethoxypolycarboxylate surfactants include those having the formula  $RO-(CHR^1-CHR^2-O)_x-R^3$  wherein R is a C6 to C18 alkyl group, x is from 1 to 25,  $R^1$  and  $R^2$  are selected from the group consisting of hydrogen, methyl acid radical, succinic acid radical, hydroxysuccinic acid radical, and mixtures thereof, and  $R^3$  is selected from the group consisting of hydrogen, substituted or unsubstituted hydrocarbon having between 1 and 8 carbon atoms, and mixtures thereof.

Suitable soap surfactants include the secondary soap surfactants which contain a carboxyl unit connected to a secondary carbon. Preferred secondary soap surfactants for use herein are water-soluble members selected from the group consisting of the water-soluble salts of 2-methyl-1-undecanoic acid, 2-ethyl-1-decanoic acid, 2-propyl-1-nonanoic acid, 2-butyl-1-octanoic acid and 2-pentyl-1-heptanoic acid. Certain soaps may also be included as suds suppressors.

Other suitable anionic surfactants are the alkali metal sarcosinates of formula  $R-CON(R^1)CH_2COOM$ , wherein R is a C5-C17 linear or branched alkyl or alkenyl group,  $R^1$  is a C1-C4 alkyl group and M is an alkali metal ion. Preferred examples are the myristyl and oleyl methyl sarcosinates in the form of their sodium salts.

Essentially any alkoxyated nonionic surfactants are suitable herein. The ethoxylated and propoxylated nonionic surfactants are preferred. Preferred alkoxyated surfactants can be selected from the classes of the nonionic condensates of alkyl phenols, nonionic ethoxylated alcohols, nonionic ethoxylated/propoxylated fatty alcohols, nonionic ethoxylate/propoxylate condensates with propylene glycol, and the nonionic ethoxylate condensation products with propylene oxide/ethylene diamine adducts.

The condensation products of aliphatic alcohols with from 1 to 25 moles of alkylene oxide, particularly ethylene oxide and/or propylene oxide, are suitable for use herein. The alkyl chain of the aliphatic alcohol can either be straight or branched, primary or secondary, and generally contains from 6 to 22 carbon atoms. Particularly preferred are the condensation products of alcohols having an alkyl group containing from 8 to 20 carbon atoms with from 2 to 10 moles of ethylene oxide per mole of alcohol.

Polyhydroxy fatty acid amides suitable for use herein are those having the structural formula  $R^2CONR^1Z$  wherein:  $R^1$  is H, C1-C4 hydrocarbyl, 2-hydroxyethyl, 2-hydroxypropyl, ethoxy, propoxy, or a mixture thereof, preferable C1-C4 alkyl, more preferably C1 or C2 alkyl, most

preferably C1 alkyl (i.e., methyl); and  $R^2$  is a C5-C31 hydrocarbyl, preferably straight-chain C5-C19 alkyl or alkenyl, more preferably straight-chain C9-C17 alkyl or alkenyl, most preferably straight-chain C11-C17 alkyl or alkenyl, or mixture thereof-, and Z is a polyhydroxyhydrocarbyl having a linear hydrocarbyl chain with at least 3 hydroxyls directly connected to the chain, or an alkoxylated derivative (preferably ethoxylated or propoxylated) thereof Z preferably will be derived from a reducing sugar in a reductive amination reaction; more preferably Z is a glycityl.

Suitable fatty acid amide surfactants include those having the formula:  $R^1CON(R^2)_2$  wherein  $R^1$  is an alkyl group containing from 7 to 21, preferably from 9 to 17 carbon atoms and each  $R^2$  is selected from the group consisting of hydrogen, C1-C4 alkyl, C1-C4 hydroxyalkyl, and  $-(C_2H_4O)_xH$ , where x is in the range of from 1 to 3.

Suitable alkylpolysaccharides for use herein are disclosed in U.S. Pat. 4,565,647 to Llenado, having a hydrophobic group containing from 6 to 30 carbon atoms and a polysaccharide, e.g., a polyglycoside, hydrophilic group containing from 1.3 to 10 saccharide units. Preferred alkylpolyglycosides have the formula:  $R^2O(C_nH_{2n}O)_t(\text{glycosyl})_x$  wherein  $R^2$  is selected from the group consisting of alkyl, alkylphenyl, hydroxyalkyl, hydroxyalkylphenyl, and mixtures thereof in which the alkyl groups contain from 10 to 18 carbon atoms; n is 2 or 3; t is from 0 to 10, and x is from 1.3 to 8. The glycosyl is preferably derived from glucose.

Suitable amphoteric surfactants for use herein include the amine oxide surfactants and the alkyl amphocarboxylic acids. Suitable amine oxides include those compounds having the formula  $R^3(OR^4)_xNO(R^5)_2$  wherein  $R^3$  is selected from an alkyl, hydroxyalkyl, acylamidopropyl and alkylphenyl group, or mixtures thereof, containing from 8 to 26 carbon atoms;  $R^4$  is an alkylene or hydroxyalkylene group containing from 2 to 3 carbon atoms, or mixtures thereof-, x is from 0 to 5, preferably from 0 to 3; and each  $R^5$  is an alkyl or hydroxyalkyl group containing from 1 to 3, or a polyethylene oxide group containing from 1 to 3 ethylene oxide groups. Preferred are C10-C18 alkyl dimethylamine oxide, and C10-18 acylamido alkyl dimethylamine oxide. A suitable example of an alkyl amphodicarboxylic acid is Miranol(TM) C2M Conc. manufactured by Miranol, Inc., Dayton, NJ.

Zwitterionic surfactants can also be incorporated into the detergent compositions in accord with the invention. These surfactants can be broadly described as derivatives of secondary and tertiary amines, derivatives of heterocyclic secondary and tertiary amines, or derivatives of quaternary ammonium, quaternary phosphonium or tertiary sulfonium compounds. Betaine and sultaine surfactants are exemplary zwitterionic surfactants for use herein.

Suitable betaines are those compounds having the formula  $R(R^1)_2N^+R^2COO^-$  wherein R is a C6-C18 hydrocarbyl. group, each  $R^1$  is typically C1-C3 alkyl, and  $R^2$  is a C1-C5 hydrocarbyl group. Preferred betaines are C12-18 dimethyl-ammonio hexanoate and the C10-18 acylamidopropane (or ethane) dimethyl (or diethyl) betaines. Complex betaine surfactants are also suitable for use herein.

Suitable cationic surfactants to be used herein include the quaternary ammonium surfactants. Preferably the quaternary ammonium surfactant is a mono C6-C16, preferably C6-

C10 N-alkyl or alkenyl ammonium surfactants wherein the remaining N positions are substituted by methyl, hydroxyethyl or hydroxypropyl groups. Preferred are also the mono-alkoxylated and bis-alkoxylated amine surfactants.

Another suitable group of cationic surfactants which can be used in the detergent compositions or components thereof herein are cationic ester surfactants. The cationic ester surfactant is a, preferably water dispersible, compound having surfactant properties comprising at least one ester (i.e. -COO-) linkage and at least one cationically charged group. Suitable cationic ester surfactants, including choline ester surfactants, have for example been disclosed in U.S. Pat. No.s 4,228,042, 4,239,660 and 4,260,529.

In one preferred aspect the ester linkage and cationically charged group are separated from each other in the surfactant molecule by a spacer group consisting of a chain comprising at least three atoms (i.e. of three atoms chain length), preferably from three to eight atoms, more preferably from three to five atoms, most preferably three atoms. The atoms forming the spacer group chain are selected from the group consisting of carbon, nitrogen and oxygen atoms and any mixtures thereof, with the proviso that any nitrogen or oxygen atom in said chain connects only with carbon atoms in the chain. Thus spacer groups having, for example, -O-O- (i.e. peroxide), -N-N-, and -N-O- linkages are excluded, whilst spacer groups having, for example -CH<sub>2</sub>-O-CH<sub>2</sub>- and -CH<sub>2</sub>-NH-CH<sub>2</sub>- linkages are included. In a preferred aspect the spacer group chain comprises only carbon atoms, most preferably the chain is a hydrocarbyl chain.

Highly preferred herein are cationic mono-alkoxylated amine surfactants preferably of the general formula:  $R^1R^2R^3N^+ApR^4X^-$  wherein  $R^1$  is an alkyl or alkenyl moiety containing from about 6 to about 18 carbon atoms, preferably 6 to about 16 carbon atoms, most preferably from about 6 to about 14 carbon atoms;  $R^2$  and  $R^3$  are each independently alkyl groups containing from one to about three carbon atoms, preferably methyl, most preferably both  $R^2$  and  $R^3$  are methyl groups;  $R^4$  is selected from hydrogen (preferred), methyl and ethyl;  $X^-$  is an anion such as chloride, bromide, methylsulfate, sulfate, or the like, to provide electrical neutrality; A is an alkoxy group, especially an ethoxy, propoxy or butoxy group; and p is from 0 to about 30, preferably 2 to about 15, most preferably 2 to about 8. Preferably the  $ApR^4$  group in the formula has p=1 and is a hydroxyalkyl group, having no greater than 6 carbon atoms whereby the -OH group is separated from the quaternary ammonium nitrogen atom by no more than 3 carbon atoms. Particularly preferred  $ApR^4$  groups are -CH<sub>2</sub>CH<sub>2</sub>-OH, -CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>-OH, -CH<sub>2</sub>CH(CH<sub>3</sub>)-OH and -CH(CH<sub>3</sub>)CH<sub>2</sub>-OH, with -CH<sub>2</sub>CH<sub>2</sub>-OH being particularly preferred. Preferred  $R^1$  groups are linear alkyl groups. Linear  $R^1$  groups having from 8 to 14 carbon atoms are preferred.

Another highly preferred cationic mono-alkoxylated amine surfactants for use herein are of the formula  $R^1(CH_3)(CH_3)N^+(CH_2CH_2O)_{2-5}H X^-$  wherein  $R^1$  is C10-C18 hydrocarbyl and mixtures thereof, especially C10-C14 alkyl, preferably C10 and C12 alkyl, and X is any convenient anion to provide charge balance, preferably chloride or bromide.

As noted, compounds of the foregoing type include those wherein the ethoxy (CH<sub>2</sub>CH<sub>2</sub>O) units (EO) are replaced by butoxy, isopropoxy [CH(CH<sub>3</sub>)CH<sub>2</sub>O] and [CH<sub>2</sub>CH(CH<sub>3</sub>)O] units (i-Pr) or n-propoxy units (Pr), or mixtures of EO and/or Pr and/or i-Pr units.

The cationic bis-alkoxylated amine surfactant preferably has the general formula: R<sup>1</sup>R<sup>2</sup>N<sup>+</sup>ApR<sup>3</sup>A'qR<sup>4</sup>X<sup>-</sup> wherein R<sup>1</sup> is an alkyl or alkenyl moiety containing from about 8 to about 18 carbon atoms, preferably 10 to about 16 carbon atoms, most preferably from about 10 to about 14 carbon atoms; R<sup>2</sup> is an alkyl group containing from one to three carbon atoms, preferably methyl; R<sup>3</sup> and R<sup>4</sup> can vary independently and are selected from hydrogen (preferred), methyl and ethyl, X<sup>-</sup> is an anion such as chloride, bromide, methylsulfate, sulfate, or the like, sufficient to provide electrical neutrality. A and A' can vary independently and are each selected from C1-C4 alkoxy, especially ethoxy, (i.e., -CH<sub>2</sub>CH<sub>2</sub>O-), propoxy, butoxy and mixtures thereof, p is from 1 to about 30, preferably 1 to about 4 and q is from 1 to about 30, preferably 1 to about 4, and most preferably both p and q are 1.

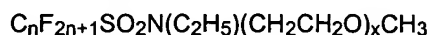
Highly preferred cationic bis-alkoxylated amine surfactants for use herein are of the formula R<sup>1</sup>CH<sub>3</sub>N<sup>+</sup>(CH<sub>2</sub>CH<sub>2</sub>OH)(CH<sub>2</sub>CH<sub>2</sub>OH)X<sup>-</sup> wherein R<sup>1</sup> is C10-C18 hydrocarbyl and mixtures thereof, preferably C10, C12, C14 alkyl and mixtures thereof X<sup>-</sup> is any convenient anion to provide charge balance, preferably chloride. With reference to the general cationic bis-alkoxylated amine structure noted above, since in a preferred compound R<sup>1</sup> is derived from (coconut) C12-C14 alkyl fraction fatty acids, R<sup>2</sup> is methyl and ApR<sup>3</sup> and A'qR<sup>4</sup> are each monoethoxy.

Other cationic bis-alkoxylated amine surfactants useful herein include compounds of the formula: R<sup>1</sup>R<sup>2</sup>N<sup>+</sup>-(CH<sub>2</sub>CH<sub>2</sub>O)<sub>p</sub>H-(CH<sub>2</sub>CH<sub>2</sub>O)<sub>q</sub>H X<sup>-</sup> wherein R<sup>1</sup> is C10-C18 hydrocarbyl, preferably C10-C14 alkyl, independently p is 1 to about 3 and q is 1 to about 3, R<sup>2</sup> is C1-C3 alkyl, preferably methyl, and X<sup>-</sup> is an anion, especially chloride or bromide.

Other compounds of the foregoing type include those wherein the ethoxy (CH<sub>2</sub>CH<sub>2</sub>O) units (EO) are replaced by butoxy (Bu) isopropoxy [CH(CH<sub>3</sub>)CH<sub>2</sub>O] and [CH<sub>2</sub>CH(CH<sub>3</sub>)O] units (i-Pr) or n-propoxy units (Pr), or mixtures of EO and/or Pr and/or i-Pr units.

The inventive compositions may include at least one fluorosurfactant selected from nonionic fluorosurfactants, cationic fluorosurfactants, and mixtures thereof which are soluble in the aqueous compositions being taught herein, particularly compositions which do not include further deterative surfactants, or further organic solvents, or both. Particularly useful nonionic fluorosurfactant compounds are found among the materials presently commercially marketed under the tradename Fluorad® (ex. 3M Corp.) Exemplary useful fluorosurfactants include those sold as Fluorad® FC-740, generally described to be fluorinated alkyl esters; Fluorad® FC-430, generally described to be fluorinated alkyl esters; Fluorad® FC-431, generally described to be fluorinated alkyl esters; and, Fluorad® FC-170-C, which is generally described as being fluorinated alkyl polyoxyethylene ethanols.

An especially useful nonionic fluorosurfactant compounds include those which is believed to conform to the following formulation:



wherein:

n has a value of from 1-12, preferably from 4-12, most preferably 8;

x has a value of from 4-18, preferably from 4-10, most preferably 7;

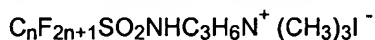
which is described to be a nonionic fluorinated alkyl alkoxylate and which is sold as Fluorad® FC-171 (ex. 3M Corp., formerly Minnesota Mining and Manufacturing Co.).

Additionally particularly useful nonionic fluorosurfactant compounds are also found among the materials marketed under the tradename ZONYL® (DuPont Performance Chemicals). These include, for example, ZONYL® FSO and ZONYL® FSN. These compounds have the following formula:



where Rf is  $\text{F}(\text{CF}_2\text{CF}_2)_y$ . For ZONYL® FSO, x is 0 to about 15 and y is 1 to about 7. For ZONYL® FSN, x is 0 to about 25 and y is 1 to about 9.

An example of a useful cationic fluorosurfactant compound has the following structure:



where  $n \sim 8$ . This cationic fluorosurfactant is available under the tradename Fluorad® FC-135 from 3M.

Another example of a useful cationic fluorosurfactant is



wherein: n is 5-9 and m is 2, and  $\text{R}_1$ ,  $\text{R}_2$  and  $\text{R}_3$  are  $-\text{CH}_3$ . This cationic fluorosurfactant is available under the tradename ZONYL® FSD (available from DuPont, described as 2-hydroxy-3-((gamma-omega-perfluoro-  $\text{C}_{6-20}$ -alkyl)thio)-N,N,N-trimethyl-1-propyl ammonium chloride).

Other cationic fluorosurfactants suitable for use in the present invention are also described in EP 866,115 to Leach and Niwata.

The fluorosurfactant selected from the group of nonionic fluorosurfactant, cationic fluorosurfactant, and mixtures thereof may be present in amounts of from 0.001 to 5% wt., preferably from 0.01 to 1% wt., and more preferably from 0.01 to 0.5% wt.

#### Solvent

Suitable organic solvents include, but are not limited to,  $\text{C}_{1-6}$  alkanols,  $\text{C}_{1-6}$  diols,  $\text{C}_{1-10}$  alkyl ethers of alkylene glycols,  $\text{C}_{3-24}$  alkylene glycol ethers, polyalkylene glycols, short chain carboxylic acids, short chain esters, isoparaffinic hydrocarbons, mineral spirits, alkylaromatics, terpenes, terpene derivatives, terpenoids, terpenoid derivatives, formaldehyde, and pyrrolidones. Alkanols include, but are not limited to, methanol, ethanol, n-propanol, isopropanol, butanol, pentanol, and hexanol, and isomers thereof. Diols include, but are not limited to, methylene, ethylene, propylene and butylene glycols. Alkylene glycol ethers include, but are not limited to, ethylene glycol monopropyl ether, ethylene glycol monobutyl ether, ethylene glycol monoethyl ether, diethylene glycol monopropyl ether, diethylene glycol monobutyl ether, diethylene glycol monoethyl ether, propylene glycol methyl ether, propylene glycol ethyl ether, propylene glycol n-propyl ether,



propylene glycol monobutyl ether, propylene glycol t-butyl ether, di- or tri-polypropylene glycol methyl or ethyl or propyl or butyl ether, acetate and propionate esters of glycol ethers. Short chain carboxylic acids include, but are not limited to, acetic acid, glycolic acid, lactic acid and propionic acid. Short chain esters include, but are not limited to, glycol acetate, and cyclic or linear volatile methylsiloxanes. Water insoluble solvents such as isoparaffinic hydrocarbons, mineral spirits, alkylaromatics, terpenoids, terpenoid derivatives, terpenes, and terpenes derivatives can be mixed with a water soluble solvent when employed.

Examples of organic solvent having a vapor pressure less than 0.1 mm Hg (20° C) include, but are not limited to, dipropylene glycol n-propyl ether, dipropylene glycol t-butyl ether, dipropylene glycol n-butyl ether, tripropylene glycol methyl ether, tripropylene glycol n-butyl ether, diethylene glycol propyl ether, diethylene glycol butyl ether, dipropylene glycol methyl ether acetate, diethylene glycol ethyl ether acetate, and diethylene glycol butyl ether acetate (all available from ARCO Chemical Company).

The solvents are preferably present at a level of from 0.001% to 10%, more preferably from 0.01% to 10%, most preferably from 1% to 4% by weight.

#### **Additional adjuncts**

The cleaning compositions optionally contain one or more of the following adjuncts: stain and soil repellants, lubricants, odor control agents, perfumes, fragrances and fragrance release agents, and bleaching agents. Other adjuncts include, but are not limited to, acids, electrolytes, dyes and/or colorants, solubilizing materials, stabilizers, thickeners, defoamers, hydrotropes, cloud point modifiers, preservatives, and other polymers. The solubilizing materials, when used, include, but are not limited to, hydrotropes (e.g. water soluble salts of low molecular weight organic acids such as the sodium and/or potassium salts of toluene, cumene, and xylene sulfonic acid). The acids, when used, include, but are not limited to, organic hydroxy acids, citric acids, keto acid, and the like. Electrolytes, when used, include, calcium, sodium and potassium chloride. Thickeners, when used, include, but are not limited to, polyacrylic acid, xanthan gum, calcium carbonate, aluminum oxide, alginates, guar gum, methyl, ethyl, clays, and/or propyl hydroxycelluloses. Defoamers, when used, include, but are not limited to, silicones, aminosilicones, silicone blends, and/or silicone/ hydrocarbon blends. Bleaching agents, when used, include, but are not limited to, peracids, hypohalite sources, hydrogen peroxide, and/or sources of hydrogen peroxide.

Preservatives, when used, include, but are not limited to, mildewstat or bacteriostat, methyl, ethyl and propyl parabens, short chain organic acids (e.g. acetic, lactic and/or glycolic acids), bisguanidine compounds (e.g. Dantagard and/or Glydant) and/or short chain alcohols (e.g. ethanol and/or IPA). The mildewstat or bacteriostat includes, but is not limited to, mildewstats (including non-isothiazolone compounds) include Kathon GC, a 5-chloro-2-methyl-4-isothiazolin-3-one, KATHON ICP, a 2-methyl-4-isothiazolin-3-one, and a blend thereof, and KATHON 886, a 5-chloro-2-methyl-4-isothiazolin-3-one, all available from Rohm and Haas Company; BRONOPOL, a 2-bromo-2-nitropropane 1, 3 diol, from Boots Company Ltd., PROXEL CRL, a propyl-p-hydroxybenzoate, from ICI PLC; NIPASOL M, an o-phenyl-phenol, Na<sup>+</sup> salt, from Nipa

Laboratories Ltd., DOWICIDE A, a 1,2-Benzisothiazolin-3-one, from Dow Chemical Co., and IRGASAN DP 200, a 2,4,4'-trichloro-2-hydroxydiphenylether, from Ciba-Geigy A.G.

#### **Antimicrobial Agent**

The compositions of the invention do not depend upon traditional antimicrobial agents for substantial microbial control. Although the compositions may contain minor amounts of traditional antimicrobials as preservatives or other uses, the compositions exhibit substantial antimicrobial control without the use of traditional quaternary ammonium compounds or phenolics. Non-limiting examples of these quaternary compounds include benzalkonium chlorides and/or substituted benzalkonium chlorides, di(C<sub>6</sub>-C<sub>14</sub>)alkyl di short chain (C<sub>1-4</sub> alkyl and/or hydroxyalkyl) quaternary ammonium salts, N-(3-chloroallyl) hexaminium chlorides, benzethonium chloride, methylbenzethonium chloride, and cetylpyridinium chloride. Other quaternary compounds include the group consisting of dialkyldimethyl ammonium chlorides, alkyl dimethylbenzylammonium chlorides, dialkylmethylbenzylammonium chlorides, and mixtures thereof. Biguanide antimicrobial actives including, but not limited to polyhexamethylene biguanide hydrochloride, p-chlorophenyl biguanide; 4-chlorobenzhydryl biguanide, halogenated hexidine such as, but not limited to, chlorhexidine (1,1'-hexamethylene -bis-5-(4-chlorophenyl biguanide) and its salts are also in this class.

#### **Builder/Buffer**

The cleaning composition may include a builder or buffer, which increase the effectiveness of the surfactant. The builder or buffer can also function as a softener and/or a sequestering agent in the cleaning composition. A variety of builders or buffers can be used and they include, but are not limited to, phosphate-silicate compounds, zeolites, alkali metal, ammonium and substituted ammonium polyacetates, trialkali salts of nitrilotriacetic acid, carboxylates, polycarboxylates, carbonates, bicarbonates, polyphosphates, aminopolycarboxylates, polyhydroxysulfonates, and starch derivatives.

Builders or buffers can also include polyacetates and polycarboxylates. The polyacetate and polycarboxylate compounds include, but are not limited to, sodium, potassium, lithium, ammonium, and substituted ammonium salts of ethylenediamine tetraacetic acid, ethylenediamine triacetic acid, ethylenediamine tetrapropionic acid, diethylenetriamine pentaacetic acid, nitrilotriacetic acid, oxydisuccinic acid, iminodisuccinic acid, mellitic acid, polyacrylic acid or polymethacrylic acid and copolymers, benzene polycarboxylic acids, gluconic acid, sulfamic acid, oxalic acid, phosphoric acid, phosphonic acid, organic phosphonic acids, acetic acid, and citric acid. These builders or buffers can also exist either partially or totally in the hydrogen ion form.

The builder agent can include sodium and/or potassium salts of EDTA and substituted ammonium salts. The substituted ammonium salts include, but are not limited to, ammonium salts of methylamine, dimethylamine, butylamine, butylenediamine, propylamine, triethylamine, trimethylamine, monoethanolamine, diethanolamine, triethanolamine, isopropanolamine, ethylenediamine tetraacetic acid and propanolamine.

Buffering and pH adjusting agents, when used, include, but are not limited to, organic acids, mineral acids, alkali metal and alkaline earth salts of silicate, metasilicate, polysilicate, borate, hydroxide, carbonate, carbamate, phosphate, polyphosphate, pyrophosphates, triphosphates, tetraphosphates, ammonia, hydroxide, monoethanolamine, monopropanolamine, diethanolamine, dipropanolamine, triethanolamine, and 2-amino-2-methylpropanol. Preferred buffering agents for compositions of this invention are nitrogen-containing materials. Some examples are amino acids such as lysine or lower alcohol amines like mono-, di-, and tri-ethanolamine. Other preferred nitrogen-containing buffering agents are tri(hydroxymethyl) amino methane (TRIS), 2-amino-2-ethyl-1,3-propanediol, 2-amino-2-methyl- propanol, 2- amino-2-methyl-1,3-propanol, disodium glutamate, N-methyl diethanolamide, 2-dimethylamino- 2-methylpropanol (DMAMP), 1,3-bis(methylamine)-cyclohexane, 1,3-diamino-propanol N,N'- tetra-methyl-1,3-diamino-2-propanol, N,N-bis(2-hydroxyethyl)glycine (bicine) and N-tris(hydroxymethyl)methyl glycine (tricine). Other suitable buffers include ammonium carbamate, citric acid, acetic acid. Mixtures of any of the above are also acceptable. Useful inorganic buffers/alkalinity sources include ammonia, the alkali metal carbonates and alkali metal phosphates, e.g., sodium carbonate, sodium polyphosphate. For additional buffers see WO 95/07971, which is incorporated herein by reference. Other preferred pH adjusting agents include sodium or potassium hydroxide.

When employed, the builder, buffer, or pH adjusting agent comprises at least about 0.001% and typically about 0.01-5% of the cleaning composition. Preferably, the builder or buffer content is about 0.01-2%.

#### **Pine oil, terpene derivatives and essential oils**

Compositions according to the invention may comprise pine oil, terpene derivatives and/or essential oils. Pine oil, terpene derivatives and essential oils are used primarily for cleaning efficacy. They may also provide some antimicrobial efficacy and deodorizing properties. Pine oil, terpene derivatives and essential oils may be present in the compositions in amounts of up to about 1% by weight, preferably in amounts of 0.01% to 0.5% by weight.

Pine oil is a complex blend of oils, alcohols, acids, esters, aldehydes and other organic compounds. These include terpenes which include a large number of related alcohols or ketones. Some important constituents include terpineol. One type of pine oil, synthetic pine oil, will generally contain a higher content of turpentine alcohols than the two other grades of pine oil, namely steam distilled and sulfate pine oils. Other important compounds include alpha- and beta-pinene (turpentine), abietic acid (rosin), and other isoprene derivatives. Particularly effective pine oils are commercially available from Mellennium Chemicals, under the Glidco tradename. These pine oils vary in the amount of terpene alcohols and alpha-terpineol.

Terpene derivatives appropriate for use in the inventive composition include terpene hydrocarbons having a functional group, such as terpene alcohols, terpene ethers, terpene esters, terpene aldehydes and terpene ketones. Examples of suitable terpene alcohols include verbenol, transpinocarveol, cis-2-pinanol, nopol, isoborneol, carbeol, piperitol, thymol, alpha-terpineol, terpinen-4-ol, menthol, 1,8-terpin, dihydro- terpineol, nerol, geraniol, linalool, citronellol,

hydroxycitronellol, 3, 7-dimethyl octanol, dihydro-myrcenol, tetrahydro-alloocimenol, perillalcohol, and falcariindiol. Examples of suitable terpene ether and terpene ester solvents include 1,8-cineole, 1,4-cineole, isobornyl methylether, rose pyran, menthofuran, trans-anethole, methyl chavicol, allocimene diepoxide, limonene mono-epoxide, isobornyl acetate, nonyl acetate, terpinyl acetate, linalyl acetate, geranyl acetate, citronellyl acetate, dihydro-terpinyl acetate and methyl acetate. Further, examples of suitable terpene aldehyde and terpene ketone solvents include myrtenal, campholenic aldehyde, perillaldehyde, citronellal, citral, hydroxy citronellal, camphor, verbenone, carvenone, dihydro-carvone, carvone, piperitone, menthone, geranyl acetone, pseudo-ionone, ionone, iso-pseudo-methyl ionone, n-pseudo-methyl ionone, iso-methyl ionone and n-methyl ionone.

Essential oils include, but are not limited to, those obtained from thyme, lemongrass, citrus, lemons, oranges, anise, clove, aniseed, pine, cinnamon, geranium, roses, mint, lavender, citronella, eucalyptus, peppermint, camphor, sandalwood, rosmarin, vervain, fleagrass, lemongrass, ratanhia, cedar and mixtures thereof. Preferred essential oils to be used herein are thyme oil, clove oil, cinnamon oil, geranium oil, eucalyptus oil, peppermint oil, mint oil or mixtures thereof.

Actives of essential oils to be used herein include, but are not limited to, thymol (present for example in thyme), eugenol (present for example in cinnamon and clove), menthol (present for example in mint), geraniol (present for example in geranium and rose), verbenone (present for example in vervain), eucalyptol and pinocarvone (present in eucalyptus), cedrol (present for example in cedar), anethol (present for example in anise), carvacrol, hinokitiol, berberine, ferulic acid, cinnamic acid, methyl salicylic acid, methyl salicylate, terpineol and mixtures thereof. Preferred actives of essential oils to be used herein are thymol, eugenol, verbenone, eucalyptol, terpineol, cinnamic acid, methyl salicylic acid, citric acid and/or geraniol.

Other essential oils include Anethole 20/21 natural, Aniseed oil china star, Aniseed oil globe brand, Balsam (Peru), Basil oil (India), Black pepper oil, Black pepper oleoresin 40/20, Bois de Rose (Brazil) FOB, Borneol Flakes (China), Camphor oil, White, Camphor powder synthetic technical, Canaga oil (Java), Cardamom oil, Cassia oil (China), Cedarwood oil (China) BP, Cinnamon bark oil, Cinnamon leaf oil, Citronella oil, Clove bud oil, Clove leaf, Coriander (Russia), Coumarin 69.degree. C. (China), Cyclamen Aldehyde, Diphenyl oxide, Ethyl vanilin, Eucalyptol, Eucalyptus oil, Eucalyptus citriodora, Fennel oil, Geranium oil, Ginger oil, Ginger oleoresin (India), White grapefruit oil, Guaiacwood oil, Gurjun balsam, Heliotropin, Isobornyl acetate, Isolongifolene, Juniper berry oil, L-methyl acetate, Lavender oil, Lemon oil, Lemongrass oil, Lime oil distilled, Litsea Cubeba oil, Longifolene, Menthol crystals, Methyl cedryl ketone, Methyl chavicol, Methyl salicylate, Musk ambrette, Musk ketone, Musk xylol, Nutmeg oil, Orange oil, Patchouli oil, Peppermint oil, Phenyl ethyl alcohol, Pimento berry oil, Pimento leaf oil, Rosalin, Sandalwood oil, Sandenol, Sage oil, Clary sage, Sassafras oil, Spearmint oil, Spike lavender, Tagetes, Tea tree oil, Vanilin, Vetyver oil (Java), Wintergreen. Each of these botanical oils is commercially available.

Particularly preferred oils include peppermint oil, lavender oil, bergamot oil (Italian), rosemary oil (Tunisian), and sweet orange oil. These may be commercially obtained from a variety of suppliers including: Givadan Roure Corp. (Clifton, N.J.); Berje Inc. (Bloomfield, N.J.); BBA Aroma Chemical Div. of Union Camp Corp. (Wayne, N.J.); Firmenich Inc. (Plainsboro N.J.); Quest International Fragrances Inc. (Mt. Olive Township, N.J.); Robertet Fragrances Inc. (Oakland, N.J.).

Particularly useful lemon oil and d-limonene compositions which are useful in the invention include mixtures of terpene hydrocarbons obtained from the essence of oranges, e.g., cold-pressed orange terpenes and orange terpene oil phase ex fruit juice, and the mixture of terpene hydrocarbons expressed from lemons and grapefruit.

#### **Polymers**

In preferred embodiments of the invention, polymeric material that improves the hydrophilicity of the surface being treated is incorporated into the present compositions. The increase in hydrophilicity provides improved final appearance by providing "sheeting" of the water from the surface and/or spreading of the water on the surface, and this effect is preferably seen when the surface is rewetted and even when subsequently dried after the rewetting. Polymer substantivity is beneficial as it prolongs the sheeting and cleaning benefits. Another important feature of preferred polymers is lack of visible residue upon drying. In preferred embodiments, the polymer comprises 0.001 to 5%, preferably 0.01 to 1%, and most preferably 0.1 to 0.5% of the cleaning composition.

In general, the aqueous polymer containing composition may comprise a water soluble or water dispersible polymer. The hydrophilic polymers preferably are attracted to surfaces and are absorbed thereto without covalent bonds. Examples of suitable polymers include the polymers and co-polymers of N,N dimethyl acrylamide, acrylamide, and certain monomers containing quaternary ammonium groups or amphoteric groups that favor substantivity to surfaces, along with co-monomers that favor adsorption of water, such as, for example, acrylic acid and other acrylate salts, sulfonates, betaines, and ethylene oxides.

With respect to the synthesis of the water soluble or water dispersible cationic copolymer, the level of the first monomer, which has a permanent cationic charge or that is capable of forming a cationic charge on protonation, is typically between 3 and 80 mol% and preferably 10 to 60 mol% of the copolymer. The level of second monomer, which is an acidic monomer that is capable of forming an anionic charge in the composition, when present is typically between 3 and 80 mol% and preferably 10 to 60 mol% of the copolymer. The level of the third monomer, which has an uncharged hydrophilic group, when present is typically between 3 and 80 mol% and preferably 10 to 60 mol% of the copolymer. When present, the level of uncharged hydrophobic monomer is less than about 50 mol% and preferably less than 10 mol% of the copolymer. The molar ratio of the first monomer to the second monomer typically ranges from 19:1 to 1:10 and preferably ranges from 9:1 to 1:6. The molar ratio of the first monomer to the third monomer is typically ranges from 4:1 to 1:4 and preferably ranges from 2:1 to 1:2.

The average molecular weight of the copolymer typically ranges from about 5,000 to about 10,000,000, with the preferred molecular weight range depending on the polymer composition with the proviso that the molecular weight is selected so that the copolymer is water soluble or water dispersible to at least 0.01% by weight in distilled water at 25°C.

Examples of permanently cationic monomers include, but are not limited to, quaternary ammonium salts of substituted acrylamide, methacrylamide, acrylate and methacrylate, such as trimethylammoniummethacrylate, trimethylammoniumpropylmethacrylamide, trimethylammoniummethacrylate, trimethylammoniumpropylacrylamide, 2-vinyl N-alkyl quaternary pyridinium, 4-vinyl N-alkyl quaternary pyridinium, 4-vinylbenzyltrialkylammonium, 2-vinyl piperidinium, 4-vinyl piperidinium, 3-alkyl 1-vinyl imidazolium, diallyldimethylammonium, and the ionene class of internal cationic monomers as described by D. R. Berger in *Cationic Surfactants, Organic Chemistry*, edited by J. M. Richmond, Marcel Dekker, New York, 1990, ISBN 0-8247-8381-6, which is incorporated herein by reference. This class includes co-poly ethylene imine, co-poly ethoxylated ethylene imine and co-poly quaternized ethoxylated ethylene imine, co-poly [(dimethylimino) trimethylene (dimethylimino) hexamethylene disalt], co-poly [(diethylimino) trimethylene (dimethylimino) trimethylene disalt], co-poly [(dimethylimino) 2-hydroxypropyl salt], co-polyquarternium-2, co-polyquarternium-17, and co-polyquarternium-18, as described in the *International Cosmetic Ingredient Dictionary*, 5th Edition, edited by J. A. Wenninger and G. N. McEwen, which is incorporated herein by reference. Other cationic monomers include those containing cationic sulfonium salts such as co-poly-1-[3-methyl-4-(vinyl-benzyloxy)phenyl]

tetrahydrothiophenium chloride. Especially preferred monomers are mono- and di-quaternary derivatives of methacrylamide. The counterion of the cationic co-monomer can be selected from, for example, chloride, bromide, iodide, hydroxide, phosphate, sulfate, hydrosulfate, ethyl sulfate, methyl sulfate, formate, and acetate.

Examples of monomers that are cationic on protonation include, but are not limited to, acrylamide, N,N-dimethylacrylamide, N,N di-isopropylacrylamide, N-vinylimidazole, N-vinylpyrrolidone, ethyleneimine, dimethylaminohydroxypropyl diethylenetriamine, dimethylaminoethylmethacrylate, dimethylaminopropylmethacrylamide, dimethylaminoethylacrylate, dimethylaminopropylacrylamide, 2-vinyl pyridine, 4-vinyl pyridine, 2-vinyl piperidine, 4-vinylpiperidine, vinyl amine, diallylamine, methyldiallylamine, vinyl oxazolidone; vinyl methyloxazolidone, and vinyl caprolactam.

Monomers that are cationic on protonation typically contain a positive charge over a portion of the pH range of 2-11. Such suitable monomers are also presented in *Water-Soluble Synthetic Polymers: Properties and Behavior*, Volume II, by P. Molyneux, CRC Press, Boca Raton, 1983, ISBN 0-8493-6136. Additional monomers can be found in the *International Cosmetic Ingredient Dictionary*, 5th Edition, edited by J. A. Wenninger and G. N. McEwen, The Cosmetic, Toiletry, and Fragrance Association, Washington D.C., 1993, ISBN 1-882621-06-9. A third source of such monomers can be found in *Encyclopedia of Polymers and Thickeners for Cosmetics*, by R. Y. Lochhead and W. R. Fron, *Cosmetics & Toiletries*, vol. 108, May 1993, pp 95-135. All three references are incorporated herein.

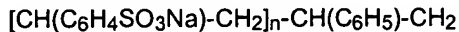
Examples of acidic monomers that are capable of forming an anionic charge in the composition include, but are not limited to, acrylic acid, methacrylic acid, ethacrylic acid, dimethylacrylic acid, maleic anhydride, succinic anhydride, vinylsulfonate, cyanoacrylic acid, methylenemalononic acid, vinylacetic acid, allylacetic acid, ethylideneacetic acid, propylideneacetic acid, crotonic acid, fumaric acid, itaconic acid, sorbic acid, angelic acid, cinnamic acid, styrylacrylic acid, citraconic acid, glutaconic acid, aconitic acid, phenylacrylic acid, acryloylpropionic acid, citraconic acid, vinylbenzoic acid, N- vinylsuccinamic acid, mesaconic acid, methacroylalanine, acryloylhydroxyglycine, sulfoethyl methacrylate, sulfopropyl acrylate, and sulfoethyl acrylate. Preferred acid monomers also include styrenesulfonic acid, 2-methacryloyloxymethane-1-sulfonic acid, 3- methacryloyloxypropane-1- sulfonic acid, 3-(vinylloxy)propane-1-sulfonic acid, ethylenesulfonic acid, vinyl sulfuric acid, 4-vinylphenyl sulfuric acid, ethylene phosphonic acid and vinyl phosphoric acid. Most preferred monomers include acrylic acid, methacrylic acid and maleic acid. The copolymers useful in this invention may contain the above acidic monomers and the alkali metal, alkaline earth metal, and ammonium salts thereof.

Examples of monomers having an uncharged hydrophilic group include but are not limited to vinyl alcohol, vinyl acetate, vinyl methyl ether, vinyl ethyl ether, ethylene oxide and propylene oxide. Especially preferred are hydrophilic esters of monomers, such as hydroxyalkyl acrylate esters, alcohol ethoxylate esters, alkylpolyglycoside esters, and polyethylene glycol esters of acrylic and methacrylic acid.

Finally, examples of uncharged hydrophobic monomers include, but are not limited to, C<sub>1</sub>-C<sub>4</sub> alkyl esters of acrylic acid and of methacrylic acid.

The copolymers are formed by copolymerizing the desired monomers. Conventional polymerization techniques can be employed. Illustrative techniques include, for example, solution, suspension, dispersion, or emulsion polymerization. A preferred method of preparation is by precipitation or inverse suspension polymerization of the copolymer from a polymerization media in which the monomers are dispersed in a suitable solvent. The monomers employed in preparing the copolymer are preferably water soluble and sufficiently soluble in the polymerization media to form a homogeneous solution. They readily undergo polymerization to form polymers which are water-dispersable or water-soluble. The preferred copolymers contain acrylamide, methacrylamide and substituted acrylamides and methacrylamides, acrylic and methacrylic acid and esters thereof. Suitable synthetic methods for these copolymers are described, for example, in Kirk-Othmer, *Encyclopedia of Chemical Technology*, Volume 1, Fourth Ed., John Wiley & Sons.

Other examples of polymers that provide the sheeting and anti-spotting benefits are polymers that contain amine oxide hydrophilic groups. Polymers that contain other hydrophilic groups such a sulfonate, pyrrolidone, and/or carboxylate groups can also be used. Examples of desirable poly-sulfonate polymers include polyvinylsulfonate, and more preferably polystyrene sulfonate, such as those sold by Monomer-Polymer Dajac (1675 Bustleton Pike, Feasterville, Pa. 19053). A typical formula is as follows.



wherein n is a number to give the appropriate molecular weight as disclosed below.

Typical molecular weights are from about 10,000 to about 1,000,000, preferably from about 200,000 to about 700,000. Preferred polymers containing pyrrolidone functionalities include polyvinyl pyrrolidone, quaternized pyrrolidone derivatives (such as Gafquat 755N from International Specialty Products), and co-polymers containing pyrrolidone, such as polyvinylpyrrolidone/dimethylaminoethylmethacrylate (available from ISP) and polyvinyl pyrrolidone/acrylate (available from BASF). Other materials can also provide substantivity and hydrophilicity including cationic materials that also contain hydrophilic groups and polymers that contain multiple ether linkages. Cationic materials include cationic sugar and/or starch derivatives and the typical block copolymer detergent surfactants based on mixtures of polypropylene oxide and ethylene oxide are representative of the polyether materials. The polyether materials are less substantive, however.

Preferred polymers comprise water soluble amine oxide moieties. It is believed that the partial positive charge of the amine oxide group can act to adhere the polymer to the surface of the surface substrate, thus allowing water to "sheet" more readily. To the extent that polymer anchoring promotes better "sheeting" higher molecular materials are preferred. Increased molecular weight improves efficiency and effectiveness of the amine oxide-based polymer. The preferred polymers of this invention have one or more monomeric units containing at least one N-oxide group. At least about 10%, preferably more than about 50%, more preferably greater than



about 90% of said monomers forming said polymers contain an amine oxide group. These polymers can be described by the general formula:

P(B)

wherein each P is selected from homopolymerizable and copolymerizable moieties which attach to form the polymer backbone, preferably vinyl moieties, e.g. C(R)<sub>2</sub>-C(R)<sub>2</sub>, wherein each R is H, C<sub>1</sub>-C<sub>12</sub> (preferably C<sub>sub.1</sub>-C<sub>sub.4</sub>) alkyl(ene), C<sub>6</sub>-C<sub>12</sub> aryl(ene) and/or B; B is a moiety selected from substituted and unsubstituted, linear and cyclic C<sub>1</sub>-C<sub>12</sub> alkyl, C<sub>1</sub>-C<sub>12</sub> alkylene, C<sub>1</sub>-C<sub>12</sub> heterocyclic, aromatic C<sub>6</sub>-C<sub>12</sub> groups and wherein at least one of said B moieties has at least one amine oxide group present; u is from a number that will provide at least about 10% monomers containing an amine oxide group to about 90%; and t is a number such that the average molecular weight of the polymer is from about 2,000 to about 500,000, preferably from about 5,000 to about 250,000, and more preferably from about 7,500 to about 200,000. Preferred polymers also include poly(4-vinylpyridine N-oxide) polymers (PVNO), wherein the average molecular weight of the polymer is from about 2,000 to about 500,000 preferably from about 5,000 to about 400,000, and more preferably from about 7,500 to about 300,000. In general, higher molecular weight polymers are preferred. Often, higher molecular weight polymers allow for use of lower levels of the wetting polymer, which can provide benefits in floor cleaner applications. The desirable molecular weight range of polymers useful in the present invention stands in contrast to that found in the art relating to polycarboxylate, polystyrene sulfonate, and polyether based additives which prefer molecular weights in the range of 400,000 to 1,500,000. Lower molecular weights for the preferred poly-amine oxide polymers of the present invention are due to greater difficulty in manufacturing these polymers in higher molecular weight.

Some non-limiting examples of homopolymers and copolymers which can be used as water soluble polymers of the present invention are: adipic acid/dimethylaminohydroxypropyl diethylenetriamine copolymer; adipic acid/epoxypropyl diethylenetriamine copolymer; polyvinyl alcohol; methacryloyl ethyl betaine/methacrylates copolymer; ethyl acrylate/methyl methacrylate/methacrylic acid/acrylic acid copolymer; polyamine resins; and polyquaternary amine resins; poly(ethenylformamide); poly(vinylamine) hydrochloride; poly(vinyl alcohol-co-6% vinylamine); poly(vinyl alcohol-co-12% vinylamine); poly(vinyl alcohol-co-6% vinylamine hydrochloride); and poly(vinyl alcohol-co-12% vinylamine hydrochloride). Preferably, said copolymer and/or homopolymers are selected from the group consisting of adipic acid/dimethylaminohydroxypropyl diethylenetriamine copolymer; poly(vinylpyrrolidone/dimethylaminoethyl methacrylate); polyvinyl alcohol; ethyl acrylate/methyl methacrylate/ethacrylic acid/acrylic acid copolymer; methacryloyl ethyl betaine/methacrylates copolymer; polyquaternary amine resins; poly(ethenylformamide); poly(vinylamine) hydrochloride; poly(vinyl alcohol-co-6% vinylamine); poly(vinyl alcohol-co-12% vinylamine); poly(vinyl alcohol-co-6% vinylamine hydrochloride); and poly(vinyl alcohol-co-12% vinylamine hydrochloride).

Polymers useful in the present invention can be selected from the group consisting of copolymers of hydrophilic monomers. The polymer can be linear random or block copolymers,

and mixtures thereof. The term "hydrophilic" is used herein consistent with its standard meaning of having affinity for water. As used herein in relation to monomer units and polymeric materials, including the copolymers, "hydrophilic" means substantially water soluble. In this regard, "substantially water soluble" shall refer to a material that is soluble in distilled (or equivalent) water, at 25° C., at a concentration of about 0.2% by weight, and are preferably soluble at about 1% by weight. The terms "soluble", "solubility" and the like, for purposes hereof, correspond to the maximum concentration of monomer or polymer, as applicable, that can dissolve in water or other solvents to form a homogeneous solution, as is well understood to those skilled in the art.

Nonlimiting examples of useful hydrophilic monomers are unsaturated organic mono- and polycarboxylic acids, such as acrylic acid, methacrylic acid, crotonic acid, maleic acid and its half esters, itaconic acid; unsaturated alcohols, such as vinyl alcohol, allyl alcohol; polar vinyl heterocyclics, such as, vinyl caprolactam, vinyl pyridine, vinyl imidazole; vinyl amine; vinyl sulfonate; unsaturated amides, such as acrylamides, e.g., N,N-dimethylacrylamide, N-t-butyl acrylamide; hydroxyethyl methacrylate; dimethylaminoethyl methacrylate; salts of acids and amines listed above; and the like; and mixtures thereof. Some preferred hydrophilic monomers are acrylic acid, methacrylic acid, N,N- dimethyl acrylamide, N,N-dimethyl methacrylamide, N-t-butyl acrylamide, dimethylamino ethyl methacrylate, thereof, and mixtures thereof.

Polycarboxylate polymers are those formed by polymerization of monomers, at least some of which contain carboxylic functionality. Common monomers include acrylic acid, maleic acid, ethylene, vinyl pyrrolidone, methacrylic acid, methacryloylethylbetaine, etc. Preferred polymers for substantivity are those having higher molecular weights. For example, polyacrylic acid having molecular weights below about 10,000 are not particularly substantive and therefore do not normally provide hydrophilicity for three rewetings with all compositions, although with higher levels and/or certain surfactants like amphoteric and/or zwitterionic detergent surfactants, molecular weights down to about 1000 can provide some results. In general, the polymers should have molecular weights of more than about 10,000, preferably more than about 20,000, more preferably more than about 300,000, and even more preferably more than about 400,000. It has also been found that higher molecular weight polymers, e.g., those having molecular weights of more than about 3,000, 000, are extremely difficult to formulate and are less effective in providing anti-spotting benefits than lower molecular weight polymers. Accordingly, the molecular weight should normally be, especially for polyacrylates, from about 20,000 to about 3,000,000; preferably from about 20,000 to about 2,500,000; more preferably from about 300,000 to about 2,000,000; and even more preferably from about 400,000 to about 1, 500,000.

Non limiting examples of polymers for use in the present invention include the following: poly(vinyl pyrrolidone/acrylic acid) sold under the name "Acrylidone"® by ISP and poly(acrylic acid) sold under the name "Accumer"® by Rohm & Haas. Other suitable materials include sulfonated polystyrene polymers sold under the name Versaflex® sold by National Starch and Chemical Company, especially Versaflex 7000. The level of polymeric material will normally be less than about 0.5%, preferably from about 0.001% to about 0.4%, more preferably from about 0.01% to

about 0.3%. In general, lower molecular weight materials such as lower molecular weight poly(acrylic acid), e.g., those having molecular weights below about 10,000, and especially about 2,000, do not provide good anti-spotting benefits upon rewetting, especially at the lower levels, e.g., about 0.02%. One should use only the more effective materials at the lower levels. In order to use lower molecular weight materials, substantivity should be increased, e.g., by adding groups that provide improved attachment to the surface, such as cationic groups, or the materials should be used at higher levels, e.g., more than about 0.05%.

### **Nanoparticles**

Nanoparticles, defined as particles with diameters of about 400 nm or less, are technologically significant, since they are utilized to fabricate structures, coatings, and devices that have novel and useful properties due to the very small dimensions of their particulate constituents. "Non-photoactive" nanoparticles do not use UV or visible light to produce the desired effects. Nanoparticles can have many different particle shapes. Shapes of nanoparticles can include, but are not limited to spherical, parallelepiped-shaped, tube shaped, and disc or plate shaped.

Nanoparticles with particle sizes ranging from about 2 nm to about 400 nm can be economically produced. Particle size distributions of the nanoparticles may fall anywhere within the range from about 1 nm, or less, to less than about 400 nm, alternatively from about 2 nm to less than about 100 nm, and alternatively from about 2 nm to less than about 50 nm. For example, a layer synthetic silicate can have a mean particle size of about 25 nanometers while its particle size distribution can generally vary between about 10 nm to about 40 nm. Alternatively, nanoparticles can also include crystalline or amorphous particles with a particle size from about 1, or less, to about 100 nanometers, alternatively from about 2 to about 50 nanometers. Nanotubes can include structures up to 1 centimeter long, alternatively with a particle size from about 1 nanometer, or less, to about 50 nanometers. Nanoparticles can be present from 0.01 to 1%.

Inorganic nanoparticles generally exist as oxides, silicates, carbonates and hydroxides. These nanoparticles are generally hydrophilic. Some layered clay minerals and inorganic metal oxides can be examples of nanoparticles. The layered clay minerals suitable for use in the coating composition include those in the geological classes of the smectites, the kaolins, the illites, the chlorites, the attapulgites and the mixed layer clays. Smectites include montmorillonite, bentonite, pyrophyllite, hectorite, saponite, sauconite, nontronite, talc, beidellite, volchonskoite and vermiculite. Kaolins include kaolinite, dickite, nacrite, antigorite, anauxite, halloysite, indellite and chrysotile. Illites include bravaisite, muscovite, paragonite, phlogopite and biotite. Chlorites include corrensitite, penninitite, donbassite, sudoite, pennine and clinochlore. Attapulgites include sepiolite and polygorskite. Mixed layer clays include alleverdite and vermiculitebiotite. Variants and isomorphic substitutions of these layered clay minerals offer unique applications.

The layered clay minerals suitable for use in the coating composition may be either naturally occurring or synthetic. An example of one embodiment of the coating composition uses natural or synthetic hectorites, montmorillonites and bentonites. Another embodiment uses the hectorites clays commercially available. Typical sources of commercial hectorites are

LAPONITE® from Southern Clay Products, Inc., U.S.A; Veegum Pro and Veegum F from R. T. Vanderbilt, U.S.A.; and the Barasyls, Macaloids and Propaloids from Baroid Division, National Read Comp., U.S.A.

The inorganic metal oxides used in the coating composition may be silica- or alumina-based nanoparticles that are naturally occurring or synthetic. Aluminum can be found in many naturally occurring sources, such as kaolinite and bauxite. The naturally occurring sources of alumina are processed by the Hall process or the Bayer process to yield the desired alumina type required. Various forms of alumina are commercially available in the form of Gibbsite, Diaspore, and Boehmite from manufacturers such as Condea.

Synthetic hectorites, such as LAPONITE RD®, do not contain any fluorine. An isomorphous substitution of the hydroxyl group with fluorine will produce synthetic clays referred to as sodium magnesium lithium fluorosilicates. These sodium magnesium lithium fluorosilicates, marketed as LAPONITE B® and LAPONITE S®, contain fluoride ions of greater than 0% up to about 8%, and preferably about 6% by weight. LAPONITE B® particles are flat disc-shaped, or plate shaped, and have a mean particle size of about 40 nanometers in diameter and about 1 nanometer in thickness. Another variant, called LAPONITE S®, contains about 6% of tetrasodium polyphosphate as an additive. In some instances, LAPONITE B® by itself is believed, without wishing to be bound to any particular theory, to be capable of providing a more uniform coating (that is, more continuous, i. e., less openings in the way the coating forms after drying), and can provide a more substantive (or durable) coating than some of the other grades of LAPONITE® by themselves (such as LAPONITE RD®).

The aspect ratio for disk shaped nanoparticles is the ratio of the diameter of the clay particle to that of the thickness of the clay particle. The aspect ratio of individual particles of LAPONITE® B is approximately 40 and the aspect ratio of individual particles of LAPONITE® RD is approximately 25. A high aspect ratio is desirable for film formation of nanosized clay materials. More important to the invention is the aspect ratio of the dispersed particles in a suitable carrier medium, such as water. The aspect ratio of the particles in a dispersed medium can be considered to be lower where several of the disc shaped particles are stacked on top of one another than in the case of individual particles. The aspect ratio of dispersions can be adequately characterized by TEM (transmission electron microscopy).

LAPONITE B® occurs in dispersions as essentially single clay particles or stacks of two or fewer clay particles. The LAPONITE RD® occurs essentially as stacks of two or more single clay particles. Thus, the aspect ratio of the particles dispersed in the carrier medium can be dramatically different from the aspect ratio of single disc-shaped particle. The aspect ratio of LAPONITE B® is about 20-40 and the aspect ratio of LAPONITE RD® is less than 15.

In some preferred embodiments, the nanoparticles will have a net excess charge on one of their dimensions. For instance, flat plate-shaped nanoparticles may have a positive charge on their flat surfaces, and a negative charge on their edges. Alternatively, such flat plate-shaped nanoparticles may have a negative charge on their flat surfaces and a positive charge on their

edges. Preferably, the nanoparticles have an overall net negative charge. This is believed to aid in hydrophilizing the surface coated with the nanoparticles. The amount of charge, or "charge density", on the nanoparticles can be measured in terms of the mole ratio of magnesium oxide to lithium oxide in the nanoparticles. In preferred embodiments, the nanoparticles have a mole ratio of magnesium oxide to lithium oxide of less than or equal to about 11%.

Depending upon the application, the use of variants and isomorphous substitutions of LAPONITE® provides great flexibility in engineering the desired properties of the coating composition used in the present invention. The individual platelets of LAPONITE® are negatively charged on their faces and possess a high concentration of surface bound water. When applied to a hard surface, the hard surface is hydrophilically modified and exhibits surprising and significantly improved wetting and sheeting, quick drying, uniform drying, anti-spotting, anti-soil deposition, cleaner appearance, enhanced gloss, enhanced color, minor surface defect repair, improved smoothness, anti-hazing properties, modification of surface friction, reduced damage to abrasion and improved transparency properties. In addition, the LAPONITE® modified surface exhibits "self-cleaning" properties (dirt removal via water rinsing, e.g. from rainwater) and/or soil release benefits (top layers are strippable via mild mechanical action).

In contrast to hydrophilic modification with organic polymers, the benefits provided by nanoparticles, such as LAPONITE®, either alone or in combination with a charged modifier, are longer lived. For example, sheeting/anti-spotting benefits are maintained on an automobile body and glass window after multiple rinses versus the duration of such benefits after only about one rinse with tap water or rainwater on a surface coated with hydrophilic polymer technology.

#### **Substances Generally Recognized As Safe**

Compositions according to the invention may comprise substances generally recognized as safe (GRAS), including essential oils, oleoresins (solvent-free) and natural extractives (including distillates), and synthetic flavoring materials and adjuvants. Compositions may also comprise GRAS materials commonly found in cotton, cotton textiles, paper and paperboard stock dry food packaging materials (referred herein as substrates) that have been found to migrate to dry food and, by inference may migrate into the inventive compositions when these packaging materials are used as substrates for the inventive compositions.

Suitable GRAS materials are listed in the Code of Federal Regulations (CFR) Title 21 of the United States Food and Drug Administration, Department of Health and Human Services, Parts 180.20, 180.40 and 180.50, which are hereby incorporated by reference. These suitable GRAS materials include essential oils, oleoresins (solvent-free), and natural extractives (including distillates). The GRAS materials may be present in the compositions in amounts of up to about 10% by weight, preferably in amounts of 0.01 and 5% by weight.

Preferred GRAS materials include oils and oleoresins (solvent-free) and natural extractives (including distillates) derived from alfalfa, allspice, almond bitter (free from prussic acid), ambergris, ambrette seed, angelica, angostura (cusparia bark), anise, apricot kernel (persic oil), asafetida, balm (lemon balm), balsam (of Peru), basil, bay leave, bay (myrcia oil), bergamot

(bergamot orange), bois de rose (*Aniba rosaeodora* Ducke), cacao, camomile (chamomile) flowers, cananga, capsicum, caraway, cardamom seed (cardamon), carob bean, carrot, cascarilla bark, cassia bark, Castoreum, celery seed, cheery (wild bark), chervil, cinnamon bark, Civet (zibeth, zibet, zibetum), ceylon (*Cinnamomum zeylanicum* Nees), cinnamon (bark and leaf), citronella, citrus peels, clary (clary sage), clover, coca (decocainized), coffee, cognac oil (white and green), cola nut (kola nut), coriander, cumin (cummin), curacao orange peel, cusparia bark, dandelion, dog grass (quackgrass, triticum), elder flowers, estragole (esdragol, esdragon, estragon, tarragon), fennel (sweet), fenugreek, galanga (galangal), geranium, ginger, grapefruit, guava, hickory bark, horehound (hoarhound), hops, horsemint, hyssop, immortelle (*Helichrysum augustifolium* DC), jasmine, juniper (berries), laurel berry and leaf, lavender, lemon, lemon grass, lemon peel, lime, linden flowers, locust bean, lupulin, mace, mandarin (*Citrus reticulata* Blanco), marjoram, mate, menthol (including menthyl acetate), molasses (extract), musk (Tonquin musk), mustard, naringin, neroli (bigarade), nutmeg, onion, orange (bitter, flowers, leaf, flowers, peel), organum, palmarosa, paprika, parsley, peach kernel (persic oil, pepper (black, white), peanut (stearine), peppermint, Peruvian balsam, petitgrain lemon, petitgrain mandarin (or tangerine), pimenta, pimenta leaf, pipsissewa leaves, pomegranate, prickly ash bark, quince seed, rose (absolute, attar, buds, flowers, fruit, hip, leaf), rose geranium, rosemary, safron, sage, St. John's bread, savory, schinus molle (*Schinus molle* L.), sloe berries, spearmint, spike lavender, tamarind, tangerine, tarragon, tea (*Thea sinensis* L.), thyme, tuberose, turmeric, vanilla, violet (flowers, leaves), wild cherry bark, ylang-ylang and zedoary bark.

Suitable synthetic flavoring substances and adjuvants are listed in the Code of Federal Regulations (CFR) Title 21 of the United States Food and Drug Administration, Department of Health and Human Services, Part 180.60, which is hereby incorporated by reference. These GRAS materials may be present in the compositions in amounts of up to about 1% by weight, preferably in amounts of 0.01 and 0.5% by weight.

Suitable synthetic flavoring substances and adjuvants that are generally recognized as safe for their intended use, include acetaldehyde (ethanal), acetoin (acetyl methylcarbinol), anethole (parapropenyl anisole), benzaldehyde (benzoic aldehyde), n-Butyric acid (butanoic acid), d- or l-carvone (carvol), cinnamaldehyde (cinnamic aldehyde), citral (2,6-dimethyloctadien-2,6-al-8, gera-nial, neral), decanal (N-decylaldehyde, capraldehyde, capric aldehyde, caprinaldehyde, aldehyde C-10), ethyl acetate, ethyl butyrate, 3-Methyl-3-phenyl glycidic acid ethyl ester (ethyl-methyl-phenyl- glycidate, so-called strawberry aldehyde, C-16 aldehyde), ethyl vanillin, geraniol (3,7-dimethyl-2,6 and 3,6-octadien-1-ol), geranyl acetate (geraniol acetate), limonene (d-, l-, and dl-), linalool (linalol, 3,7-dimethyl-1,6-octadien-3-ol), linalyl acetate (bergamol), methyl anthranilate (methyl-2-aminobenzoate), piperonal (3,4-methylenedioxy-benzaldehyde, heliotropin) and vanillin.

Suitable GRAS substances that may be present in the inventive compositions that have been identified as possibly migrating to food from cotton, cotton textiles, paper and paperboard materials used in dry food packaging materials are listed in the Code of Federal Regulations (CFR) Title 21 of the United States Food and Drug Administration, Department of Health and Human

Services, Parts 180.70 and 180.90, which are hereby incorporated by reference. The GRAS materials may be present in the compositions either by addition or incidentally owing to migration from the substrates to the compositions employed in the invention, or present owing to both mechanisms. If present, the GRAS materials may be present in the compositions in amounts of up to about 1% by weight.

Suitable GRAS materials that are suitable for use in the invention, identified as originating from either cotton or cotton textile materials used as substrates in the invention, include beef tallow, carboxymethylcellulose, coconut oil (refined), cornstarch, gelatin, lard, lard oil, oleic acid, peanut oil, potato starch, sodium acetate, sodium chloride, sodium silicate, sodium tripolyphosphate, soybean oil (hydrogenated), talc, tallow (hydrogenated), tallow flakes, tapioca starch, tetrasodium pyrophosphate, wheat starch and zinc chloride.

Suitable GRAS materials that are suitable for use in the invention, identified as originating from either paper or paperboard stock materials used as substrates in the invention, include alum (double sulfate of aluminum and ammonium potassium, or sodium), aluminum hydroxide, aluminum oleate, aluminum palmitate, casein, cellulose acetate, cornstarch, diatomaceous earth filler, ethyl cellulose, ethyl vanillin, glycerin, oleic acid, potassium sorbate, silicon dioxides, sodium aluminate, sodium chloride, sodium hexametaphosphate, sodium hydrosulfite, sodium phosphoaluminate, sodium silicate, sodium sorbate, sodium tripolyphosphate, sorbitol, soy protein (isolated), starch (acid modified, pregelatinized and unmodified), talc, vanillin, zinc hydrosulfite and zinc sulfate.

#### **Water**

Since the composition is an aqueous composition, water can be, along with the solvent, a predominant ingredient. The water should be present at a level of less than 99.9%, more preferably less than about 99%, and most preferably, less than about 98%. Deionized water is preferred.

#### **Method of Use**

The wipe or cleaning pad can be used for cleaning, disinfectancy, or sanitization on inanimate, household surfaces, especially glass surfaces, but also including floors, counter tops, furniture, windows, walls, and automobiles. Other glossy surfaces include stainless steel, chrome, and shower enclosures. The wipe or cleaning pad can be packaged individually or together in canisters, tubs, etc. The wipe or cleaning pad can be used with the hand, or attached to a tool or motorized tool, such as one having a handle.

### **EXAMPLES**

#### **Disinfectancy Testing**

Wipes disinfectancy testing differs from spray testing. For spray testing, each inoculum sample is sprayed for 2-3 seconds. For wipes testing, a folded wipe is used to treat 10 carriers. Therefore, compositions passing disinfectancy for a spray product may not pass when applied on a wipe.

The following formulas in Tables 1 and 2 were tested on Ahlstrom 4759 with a loading of 2.5g of liquid composition per 1 g of substrate and tested for disinfectancy on Salmonella or E.coli.

Table 1

	Type	Inventive A	Inventive B	Inventive C
Isopropanol <sup>a</sup>	Solvent	1.0%		
Propyleneglycol N-butyl ether <sup>b</sup>	Solvent	1.5%	1.5%	0.7%
Octyldiphenyloxide disulfonate <sup>c</sup>	Surfactant	0.05%	0.05%	0.05%
Sodium dodecylbenzene sulfonate <sup>e</sup>	Surfactant			
Sodium hydroxide <sup>f</sup>	Buffer	0.5%	0.7%	1.5%
d-limonene <sup>g</sup>	Essential oil			
Balance water				
pH		12.45	12.5	12.5
Disinfectant		Yes	Yes	Yes

a. Union Carbide Corporation.

b. ARCO Chemical Company.

c. Dowfax 2A1 from Dow Chemical.

d. Dow Chemical.

e. Stepan Chemical.

f. J.T. Baker.

g. Givaudan Corporation.

Table 2

	Type	Inventive D	Inventive E	Inventive F
Isopropanol <sup>a</sup>	Solvent	1.8%	1.0%	1.0%
Propyleneglycol N-butyl ether <sup>b</sup>	Solvent		2.6%	2.6%
Octyldiphenyloxide disulfonate <sup>c</sup>	Surfactant		0.05%	0.05%
Sodium dodecylbenzene sulfonate <sup>e</sup>	Surfactant	0.1%		
Sodium hydroxide <sup>f</sup>	Buffer	1.5%	0.15%	0.3%
d-limonene <sup>g</sup>	Essential oil	0.1%		
Balance water				
pH		12.6	10.6	11.75



Disinfectant		Yes	Yes	Yes
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The following formulas in Table 3 can be applied to Dexter 10180 with a loading of 4g of liquid composition per 1 g of substrate.

Table 3

	Type	Inventive G	Inventive H	Inventive I	Inventive J	Inventive K
Ethanol	Solvent	0.5%	0.5%	0.5%		
Tripropyleneglycol N-butyl ether <sup>a</sup>	Solvent				0.3%	0.3%
Sodium dodecylbenzene sulfonate	Surfactant	0.03%	0.1%	0.1%		
Sodium lauryl sulfate <sup>b</sup>	Surfactant				0.1%	0.1%
Lavender oil <sup>c</sup>	Essential oil	0.02%				
Sodium hydroxide	Buffer	0.5%	0.7%	0.5%	0.7%	0.7%
Nanoparticle <sup>d</sup>				0.05%		0.1%
Hydrophilic polymer <sup>e</sup>			0.1%		0.01%	
Balance water						

a. ARCO Chemical Company.

b. Stepan Company.

c. Firmenich, Inc.

d. LAPONITE RD ® from Southern Clay Products.

e. Vinylpyrrolidone dimethylaminoethylmethacrylate polymer from International Specialty Products.

The following formulas in Table 4 can be applied to Ahlstrom 4759 with a loading of 4.0g of liquid composition per 1 g of substrate.

Table 4

	Type	Inventive L	Inventive M
Ethanol	Solvent		0.05%
Propyleneglycol <sup>a</sup>	Solvent	0.5%	
Tripropyleneglycol N-butyl ether	Solvent	0.4%	
Alkylpolyglucoside <sup>b</sup>	Surfactant	0.1%	